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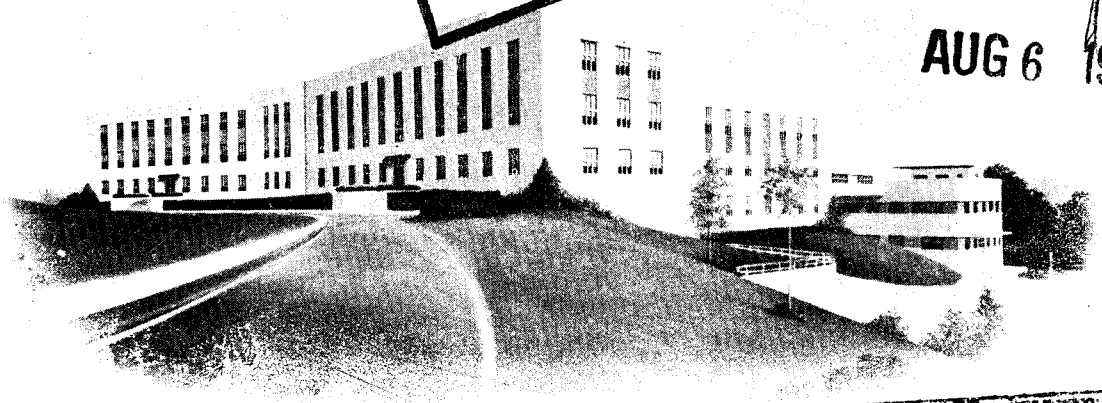

MODIFICATION OF THE BECKMAN SPECTROPHOTOMETER WITH AN EXTERNAL "C" BATTERY SUPPLY AND A VOLTAGE-CHECKING ARRANGEMENT

MEMORANDUM REPORT 52-4

Project NM 000 018.07.16

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ABSTRACT

Several objections are noted to inverting the Beckman Spectrophotometer whenever "C'' batteries and/or plate or screen voltages of the amplifier tubes need changing. These objections become more serious in cases where the optical alignment of accessories cannot be disturbed by movement of the instrument. A modification is described for placing the "C" battery supply external to the spectrophotometer and incorporating a voltage-checking arrangement. Circuit diagrams for pre-and post-conversion are presented for the components, all of which are normally available from an electronics stockroom.

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INTRODUCTION

Whenever the "C" batteries of the Beckman Spectrophotometer (Model DU) need checking or replacement, the necessity of inverting the instrument presents several difficulties. The size and weight of the spectrophotometer are such that unless extreme care is exercised during this manipulation, jarring of the instrument and damage may result. After replacement of the dry batteries, it is frequently necessary to change the plate and/or screen voltages to the amplifier tubes. Improper voltages are detected by observing the action of the galvanometer needle under operating conditions while the spectrophotometer is inverted. This procedure is inconvenient and awkward and can be avoided by locating the dry cells outside of the instrument housing.

More serious objections arise when the Beckman Spectrophotometer is employed with accessories for which the optical alignment of the parts is of paramount importance. In the commercially-supplied accessories (e.g., the flame photometer attachment), an attempt is made to insure optimum alignment by providing detents for the feet of the spectrophotometer. However, in the use of some auxiliary units which have been developed for specific purposes in our laboratories, it is imperative that the instrument be not moved during a relatively long series of dependent measurements (1, 2). Therefore, a method was devised to eliminate the necessity of inverting the spectrophotometer for the purposes mentioned above.*

Design:

In order to relocate the "C" batteries in a more convenient and accessible position, a hole 3/4-inch in diameter was cut in the side of the spectrophotometer case at the lower left end of the battery compartment (as the operator views the instrument). One end of a 12-conductor, rubber-covered cable was passed through this hole and connections made by lugs to the 12 terminals on the two strips in the spectrophotometer. With the 10-terminal strip numbered by the manufacturer, the 2-terminal strip was arbitrarily numbered 11 and 12, with position 12 adjacent to terminal 1.

A few simple changes were made in the battery compartment wiring which did not in any way alter the original main circuit of the instrument. Figure 1A shows the " Spectrophotometer Cable Connection Diagram" (3), while figure 1B indicates how that diagram was modified by an external relocation of the "C" batteries. The " Model DU Spectrophotometer Wiring Diagram ". (4) lists the lead numbers. With reference to that diagram, the wiring changes are as follows:

a. The jumper between terminals 11 and 12 is removed.

b. The jumper between terminals 7 and 12 is removed.

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*It is recognized that the desiccant in the monochromator-housing can not be reached without movement of the instrument; however, new desiccant will be effective for long periods in normal laboratory environment, and indefinitely so if the spectrophotometer is operated in a humidity-controlled room.

c. The lead No. 30 which connects battery No. 1 to terminal 3, is removed.

d. The lead No. 29 (red), originally connected to battery No. 4, is changed to terminal 11.

e. The lead No. 34 (red), originally connected to battery No. 6, is changed to terminal 12.

The 12-conductor cable which extended about 18 inches from the spectrophotometer was terminated at a 12-prong Jones plug. The corresponding chassis connector was mounted in a 6 in. x 6 in. x 6 in. metal cabinet in which the six "C" batteries were placed with suitable insulation. The chassis connector was wired to the terminals of a 12-position selector switch (Mallory No. 32112J). The "C" batteries were also connected to this switch via a binding post terminal block to facilitate battery changing.

A pair of binding posts was mounted on the cabinet panel, connected to ground and to the selector switch arm. This permitted voltage readings to be made selectively from the 12 terminals within the spectrophotometer. The procedure for checking these voltages is recommended by the manufacturer, and correct values for terminals 1 through 10 are listed in their Servicing Bulletin (5). Voltage values for terminals 11 and 12 should read +20 volts and " slightly positive", respectively. Terminal 8 is "ground" and the battery cabinet case can be connected to it for shielding. Figure 2 is a wiring diagram of the battery cabinet as described.

Figure 3A shows the battery cabinet connected to the Beckman Spectrophotometer. The front panel of the cabinet has been removed in figure 3B to expose the wiring and "C" batteries in position.

CONCLUSIONS

The external "C" battery supply described above has been used routinely in this laboratory with success. As a result, the time required for diagnosing and eliminating instrumental troubles arising from "C" battery failure has been materially reduced by this modification.

SUMMARY

Several objections are noted to inverting the Beckman Spectrophotometer whenever "C" batteries and/or plate or screen voltages of the amplifier tubes need changing. These objections become more serious in cases where the optical alignment of accessories would be disturbed by movement of the instrument.

A modification is described for placing the "C" battery supply external to the spectrophotometer and incorporating a voltage-checking arrangement. Circuit diagrams for pre-and post-conversion are presented. The components used for the modification are normally available from an electronics stockroom.

ACKNOWLEDGMENT

The authors wish to express their appreciation to T. P. Nordquist, HN, USN for his technical assistance.

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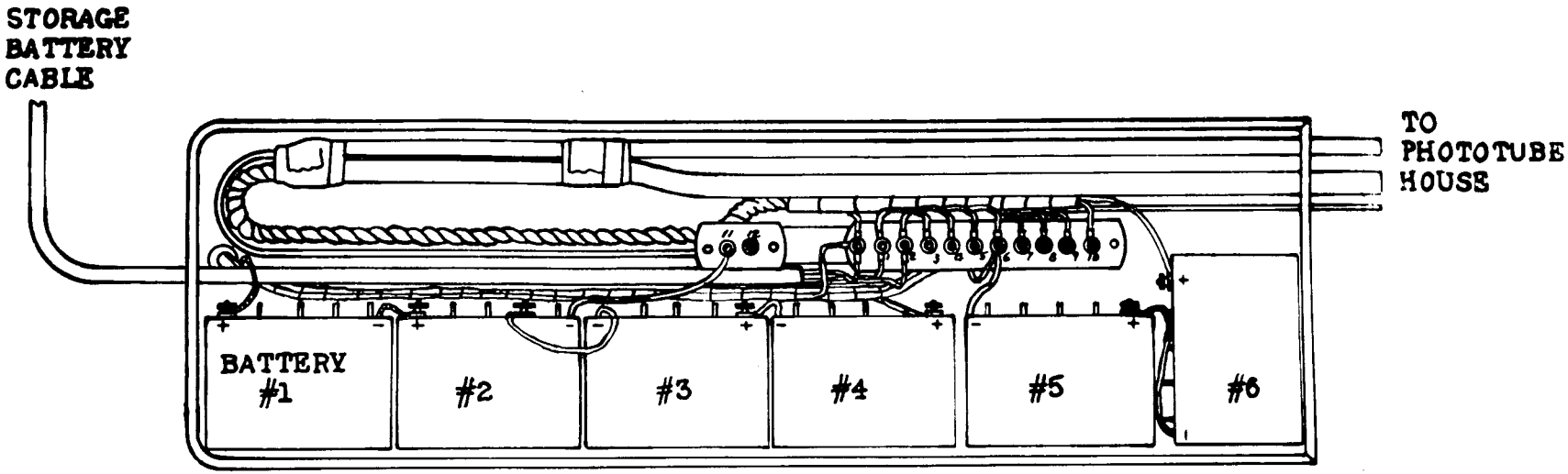

Figure 1A. Beckman Spectrophotometer cable connection diagram. (3).

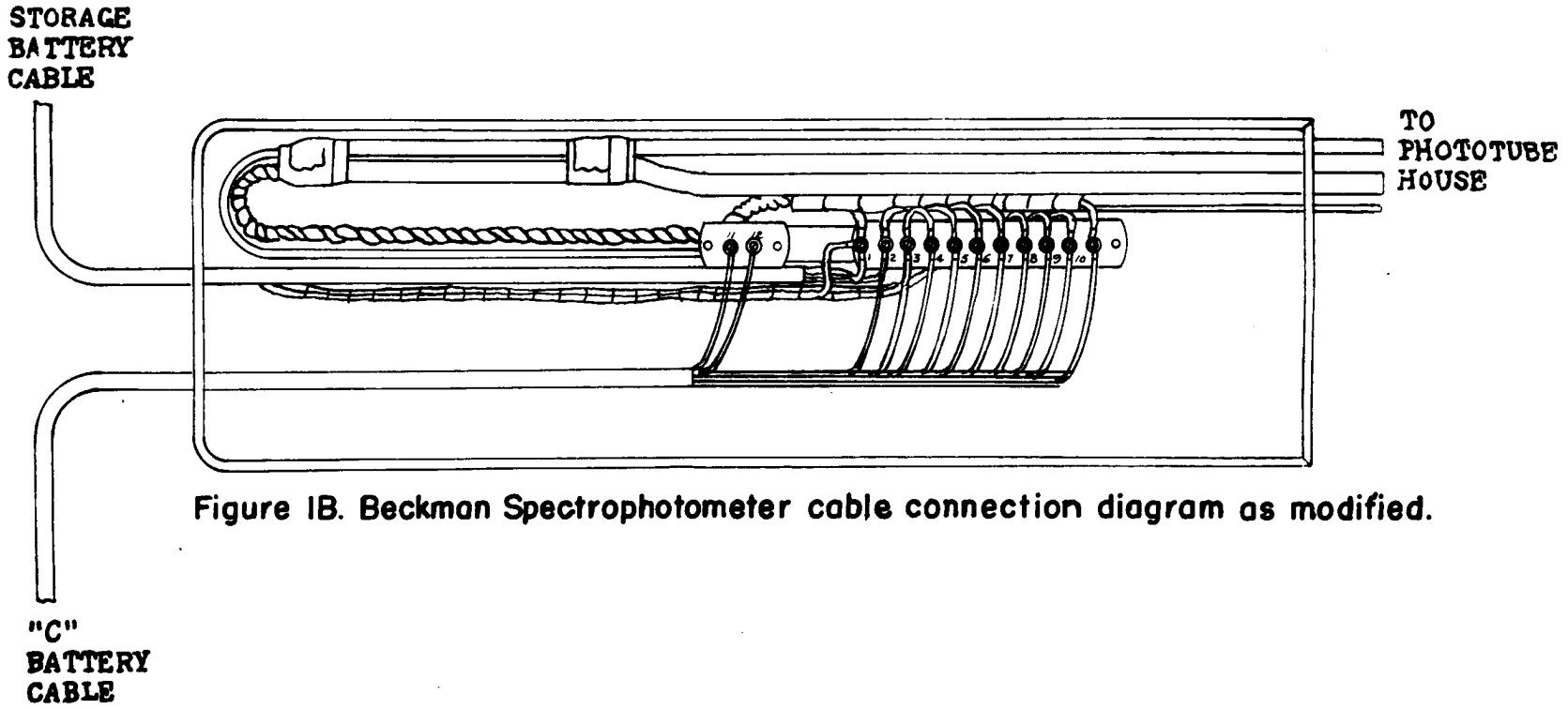

Figure 1B. Beckman Spectrophotometer cable connection diagram as modified.

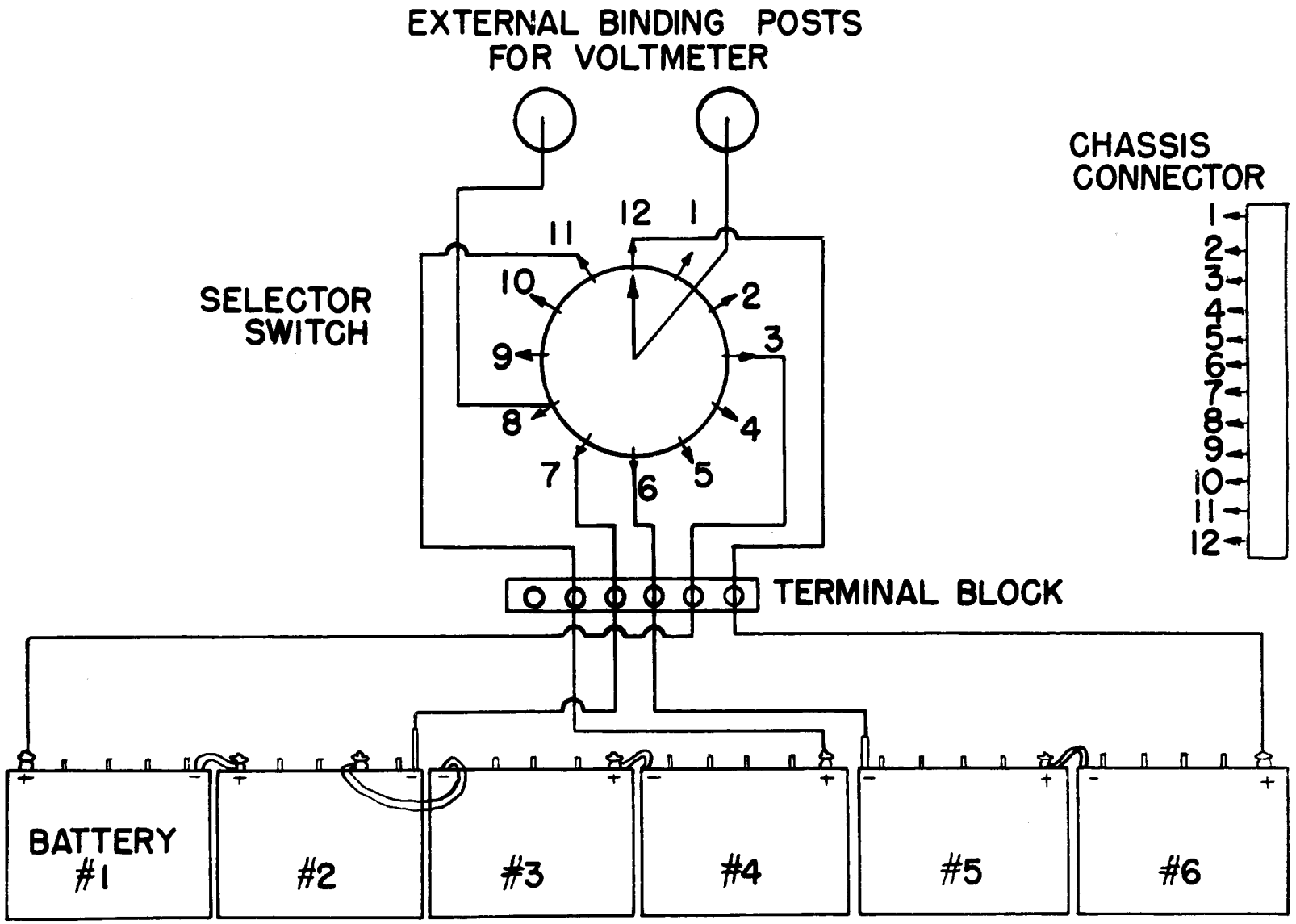

Figure 2. Wiring diagram of external battery supply for Beckman Spectrophotometer.

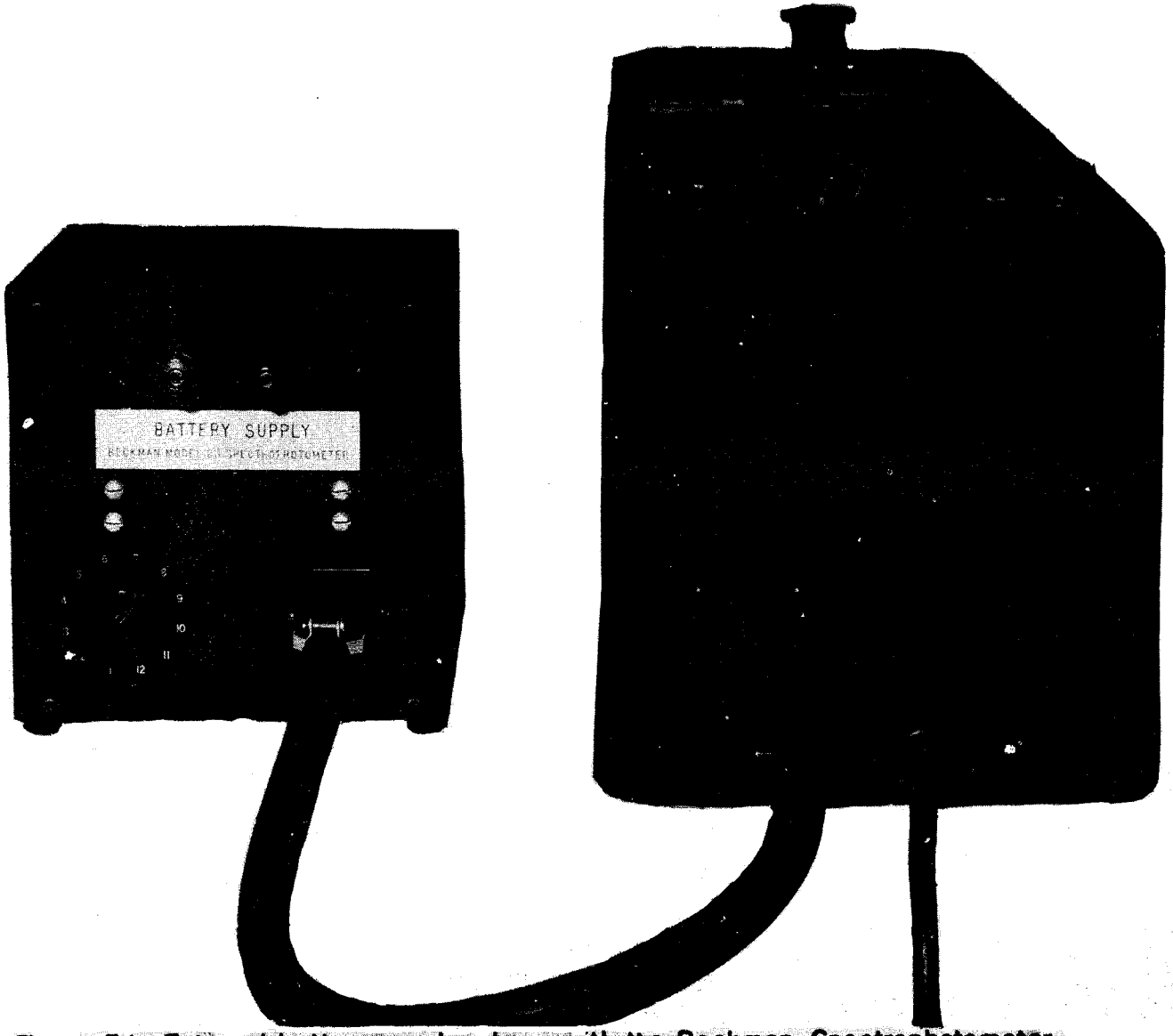

Figure 3A. External battery supply shown with the Beckman Spectrophotometer.

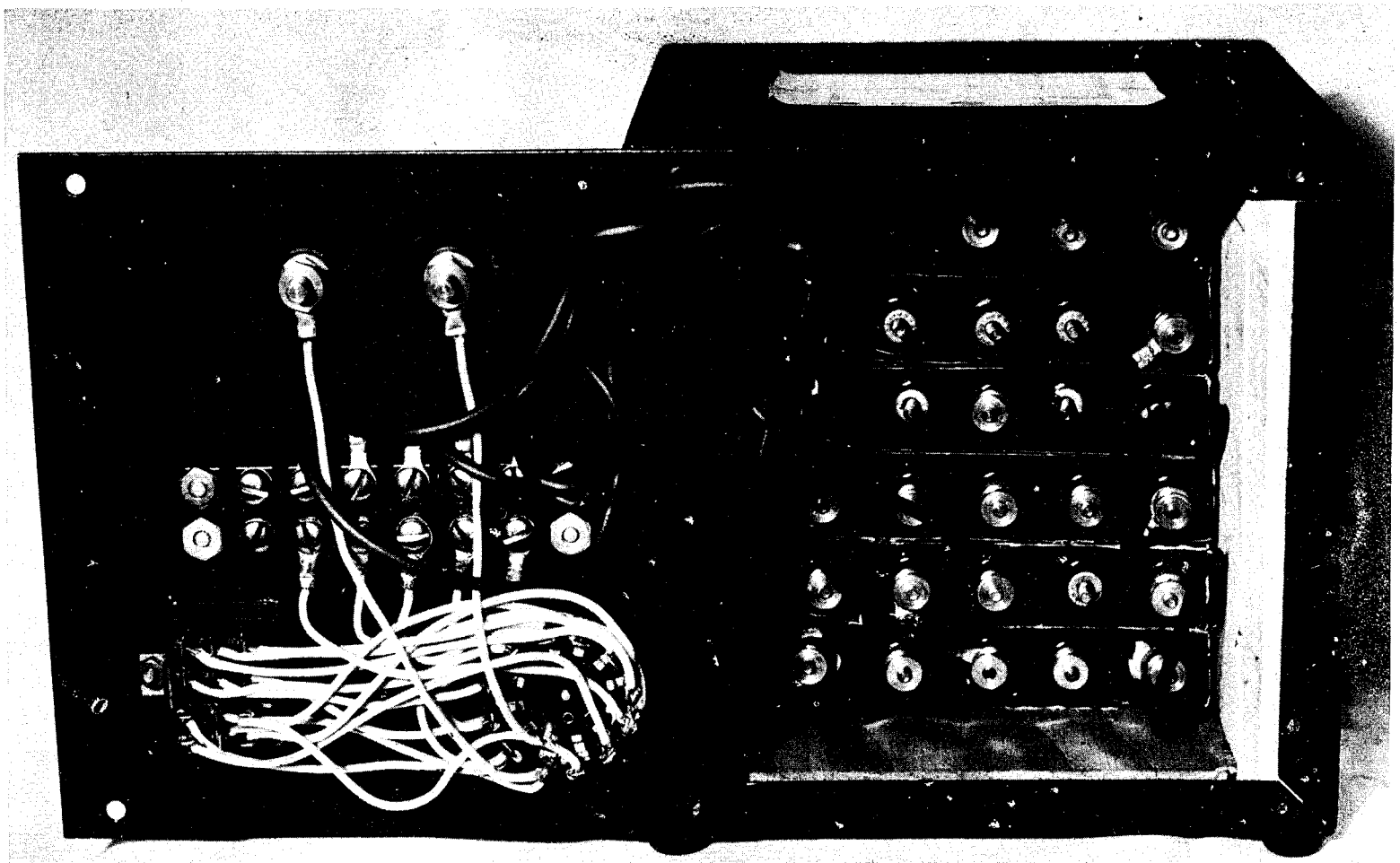

Figure 3B. External battery supply with front panel removed.